

Semivolatile Organic Compounds in Adipose Tissue: Estimated Averages for the US Population and Selected Subpopulations

ABSTRACT

Objectives. The fiscal year (FY) 1986 Environmental Protection Agency National Human Adipose Tissue Survey (NHATS) was conducted to estimate average concentrations of 111 semivolatiles in human adipose tissue within the US general population and selected subpopulations.

Methods. Population and subpopulation estimates of average semivolatile concentrations were established from 671 adipose tissue specimens pooled across 50 analytical samples.

Results. Among polychlorinated biphenyls (PCBs), average concentrations for the group aged 45 and older were from 188% to 706% higher than for the 0- through 14-year-old age group. Similar increases with age were observed for pesticides. Geographic effects on average concentration were mixed, and no significant race or sex effects were observed. Statistically significant increases from FY 1982 NHATS results were observed for PCBs and hexachlorobenzene, whereas a decrease from FY 1982 was significant for beta-BHC (benzene hexachloride). Increases from FY 1984 NHATS results were significant for p,p-DDT (dichlorodiphenylethylene), p,p-DDE (dichlorodiphenyldichlor), hexachlorobenzene, and PCBs.

Conclusions. The survey establishes baseline average levels of semivolatile compounds in the adipose tissue of US residents. (*Am J Public Health.* 1996;86:1253-1259)

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Introduction

Established in 1967, the National Human Monitoring Program characterized residues of potential toxic compounds existing in the body tissues of the US population. The main operative component of the program was the National Human Adipose Tissue Survey (NHATS), a national survey operated since the early 1970s by the US Environmental Protection Agency (EPA). Addressing the human and environmental monitoring mandates of the Toxic Substances Control Act, the NHATS has collected and analyzed human adipose tissue samples on an annual basis to characterize baseline levels of toxic compounds.¹ Because most of these compound classifications tend to accumulate in adipose tissue, the NHATS has provided a mechanism for monitoring low level chronic exposures. In 1989, the National Academy of Sciences' (NAS) Committee on National Monitoring of Human Tissues began a review of NHATS and similar human tissue monitoring programs.² The Committee's recommendations were discussed at the 1993 conference on Human Tissue Monitoring and Specimen Banking.³

Prior to 1982, the NHATS program focused on monitoring the levels of organochlorine pesticides and polychlorinated biphenyls (PCBs) in human adipose tissue. In fiscal year (FY) 1982, EPA conducted the first broad-scan analysis,^{4,5} which targeted additional semivolatile organic compounds, including dioxins and furans, as well as volatile organic compounds and trace elements. Semivolatiles were also targeted in the FY 1984⁶ and FY 1986 surveys. The FY 1987 survey focused on the analysis of 15 polychlorinated dibenzo-*p*-dioxin and polychlorinated-dibenzofuran isomers.⁷

This paper presents an overview of the objectives, sampling design, and results of analysis performed on tissue samples from the FY 1986 NHATS. Complete details on the analysis of FY 1986 NHATS data are available in an EPA report.⁸

The specific objectives of the FY 1986 NHATS and analysis were the following:

- To determine the extent to which the 111-targeted semivolatile organic compounds were present in human adipose tissue;
- To estimate the average concentrations of semivolatiles in the adipose tissue of humans in the US population and in various subpopulations;
- To determine if key demographic factors (geographic region, age, race, and sex classification) were associated with the average concentrations of semivolatiles in human adipose tissue;
- For selected semivolatiles, to compare the estimated average concentration levels in the FY 1986 NHATS with estimates from the FY 1982 and FY 1984 NHATS.

Methods

Study Design

The NHATS used a multistage sampling design consisting of the following

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This paper was accepted January 3, 1996.

TABLE 1—Numbers and Percentages of Specimens Collected and Composite Samples Constructed in the FY 1986 NHATS, by Subpopulation

Subpopulation	FY 1986 NHATS				1980 Census, %
	Specimens		Composites		
	No.	%	No.	%	
Census region ^a					
Northeast	123	18	9	18	26
North Central	248	37	16	32	22
South	205	31	15	30	33
West	95	14	10	20	19
Age group ^a					
0–14 y	108	16	10	20	23
15–44 y	221	33	16	32	46
45+ y	342	51	24	48	31
Sex ^b					
Male	315	47	14	44	49
Female	356	53	18	56	51
Mixed ^c			18		
Race group ^b					
White	526	78	16	76	83
Non-White	145	22	5	24	17
Mixed ^c			29		
Total	671		50		

Note. NHATS = National Human Adipose Tissue Survey.

^aAll specimens within a given composite originated from the same census region and age group.

^bThe percentage of composites for each sex and race group is calculated from the total number of pure composites. For example, 14 of the 32 (44%) pure sex composites were composed of specimens from males only.

^cMixed composites contain specimens from both sex (or race) groups.

three components:

- The 48 contiguous states were stratified into 17 geographical areas ("strata") defined by the intersection of the 9 US Census divisions and the 10 EPA regions.
- Within a stratum, a sample of metropolitan statistical areas (MSAs) was selected. The probability of selecting a metropolitan statistical area was proportional to its population percentage within the stratum.
- One or more cooperators (hospital pathologists or medical examiners) were chosen from each MSA and were asked to supply a specified quota of tissue specimens to the NHATS.

From October 1985 through September 1986, the cooperators collected adipose tissue specimens for the FY 1986 NHATS. Only cadavers and surgical patients were specimen donors owing to the invasive nature of the process required to collect the adipose specimens from living persons.

The FY 1986 NHATS sampling design contained 46 MSAs from 14 of the 17 sampling strata. As MSAs were se-

lected with probability proportional to population size, 3 sampling strata with small population sizes (Arizona-Nevada, Idaho, and New Mexico) had no MSAs selected. To simplify presentation and interpretation of results, geographic comparisons were conducted across the four US Census regions (Northeast, North Central, South, and West), rather than across sampling strata.

Quotas on the number of adipose tissue specimens requested from each cooperator were assigned to each sampling stratum. Within each MSA, these quotas were subdivided into demographic subquotas for each age group (0 through 14 years, 15 through 44 years, and 45 years and older), race group (White and non-White), and sex group. The subquotas assigned to each MSA were determined by the demographic makeup of the stratum to which the MSA belonged, on the basis of 1980 US Census information.

The manner in which cooperators selected the donors and tissue specimens was nonprobabilistic, but followed a specific set of criteria. If the specimen was collected postmortem, the tissue must have originated from an unembalmed

cadaver that had been dead for less than 24 hours and had been kept under refrigeration since death. The death must have been caused by sudden traumatic injury, such as cardiac arrest, car accident, or gunshot wound. Also, institutionalized individuals, persons known to be occupationally exposed to toxic chemicals, persons who died of pesticide poisoning, and persons suffering from cachexia were excluded from the NHATS.

Interpretation of statistical estimates derived from the NHATS data depends on the following assumptions:

- The concentrations of toxic substances in the adipose tissue of cadavers and surgical patients are comparable to those in the general population.
- Selecting cooperators only from MSAs (i.e., urban areas) does not introduce any significant bias into the estimates of average concentration levels for the US population.
- No systematic bias is introduced by the fact that the cooperators are not randomly selected and that the donors and specimens are nonprobabilistically sampled according to pre-specified quotas.

In its review of the NHATS program, the NAS Committee on National Monitoring of Human Tissues² concluded that some of these assumptions may result in certain biases. In particular, the committee concluded that rural populations may not be adequately represented.

A total of 671 specimens collected for the FY 1986 NHATS fell within the prespecified quotas and subquotas. These specimens originated from 31 of the 46 MSAs, representing all 14 sampling strata. These areas are listed in the EPA report.⁸ Table 1 presents the distribution of these specimens across each of the four analysis factors (census region, age group, race, and sex of donor). For comparative purposes, the population distribution as estimated by the 1980 US Census is included in Table 1 for each analysis factor.

In part to ensure sufficient tissue mass for chemical analysis, it was necessary to conduct chemical analysis on composite samples consisting of multiple tissue specimens. To ensure that the results of analysis on composite samples could be used to address the study objectives, specimens were assigned to composite samples according to specific design criteria.⁸ As age group and US Census division were considered impor-

tant demographic factors in determining the extent of exposure to semivolatile compounds, it was desired to have maximum precision for estimating differences in average concentration between these factors. As a result, each composite sample contained specimens from the same age group and US Census division. While it was also desired to have specimens of the same sex and race group within a composite sample, this was not possible given the numbers of collected specimens. As a result, the effect of sex and race on average concentration was expressed as a function of the percentage of male specimens and the percentage of White specimens within the composite. For comparative purposes, the composite design for the FY 1986 NHATS resembles designs used in the FY 1982 and FY 1984 NHATS.

Fifty composite samples were formulated from the 671 specimens. This number was limited by the chemical analysis budget. Table 1 indicates the number and percentage of composite samples whose specimens were exclusively from a given demographic category. Of the 50 composite samples, 18 consisted of specimens from both sexes, and 29 contained specimens from both White and non-White donors.

Sample Preparation and Chemical Analysis

The 50 composite samples in the FY 1986 NHATS were prepared in the analysis laboratory for determination of semivolatile compounds using high-resolution gas chromatography/mass spectrometry. The detection limit for a given compound was determined individually for each sample. The performance of the analysis effort was demonstrated through recoveries of surrogate compounds and internal quantitation standards, as well as through analysis on quality control samples (method blanks, unspiked control tissue samples, and spiked control tissue samples). Procedures for performing sample preparation and chemical analysis, quality control procedures, and method performance results are detailed in the EPA report.⁸

Analysis

The statistical analysis of FY 1986 NHATS data had three objectives:

- To estimate average concentration levels of target semivolatile compounds in the adipose tissue of individuals in the US population

and for various demographic subpopulations;

- To estimate standard errors for these average levels;
- To perform statistical hypothesis tests to determine if these average levels differ significantly within the four demographic factors (Census region, age group, race, and sex).

Statistical analysis was performed on data for each compound detected in at least 50% of the composites and that satisfied method performance criteria based on analysis of laboratory quality-control samples.

Prior to statistical summary and analysis, data were adjusted for the recovery of spiked surrogate compounds.⁹ This adjustment was made in an attempt to remove a potential source of systematic error in the measured concentrations and to provide for more accurate estimates of true concentration levels and characterization of time trends.

The statistical model fitted to the FY 1986 NHATS data expressed composite sample concentration as a linear function of the effects of census region, age group, race, and sex. Because the composite samples contained specimens from different sex and race groups, these factors were included in the model as continuous variables, representing the percentage of specimen from males and Whites, respectively. A regression approach was then used to test for the effects of these factors and to estimate the average concentrations for the 48 subpopulations defined by all combinations of census region, age group, sex, and race, as well as for the entire nation. Because composite sample concentrations represent the average concentration among the specimens within the composite, the model is used to characterize levels for individuals within the subpopulations of interest.

Two factors in the statistical model had random effects on the observed concentration within specimens: the sampling of MSAs from which specimens originate and the sampling of individuals within MSAs (and the selecting of specimens from individual donors). A third factor in the model represented random measurement error associated with observed concentrations within the composite samples.

The statistical model was fitted with an iteratively reweighted generalized least squares method.¹⁰ The resulting model parameter estimates were used to estimate average concentrations for each of

the 48 subpopulations. Estimates from these subpopulations, weighted by the proportion of US population in each subpopulation (based on the 1980 Census), were averaged to obtain the estimated average concentrations for specific demographic categories. Standard errors were presented as percentages relative to the estimated average concentration.

To determine whether average concentration differs significantly across categories within the geographic or demographic factors, statistical hypothesis tests were performed with the likelihood ratio method.¹¹ For example, the hypothesis that average concentration levels do not differ among the four census regions was tested against the alternative hypothesis that there is at least one pair of regions for which the average concentrations differ. Similar tests were performed to determine if significant age, race, or sex effects existed.

More details on the statistical model and hypothesis testing methods are available in an EPA report.¹²

Results

The analysis of NHATS FY 1986 composite samples resulted in measured concentrations for 111 semivolatile compounds. A table summarizing these measured concentrations is available from the authors; for each compound, this table gives the percentage of the 50 composite samples in which the compound was detected, the average detection limit, and the average, minimum, median, and maximum measured concentration. These data summaries are not meant to characterize concentration levels within the US population. Because these results reflect analysis on composite samples and are assumed to represent an average of individual specimen concentrations, we expect that the actual range of concentrations among individuals in the US population would be greater than that observed for the composite samples.

Population Estimates

Sixteen of the 111 compounds were detected in at least 50% of the composites in a way that satisfied method performance criteria based on analysis of laboratory quality-control samples. Only these compounds were included in statistical modeling. Table 2 lists these compounds, their estimated average concentrations for the nation and for the various subpopulations, and the model-based relative standard errors of these estimates. Stan-

TABLE 2—Estimated Average Concentrations (ng/g) with Relative Standard Errors (%) for Selected Semivolatiles in the FY 1986 NHATS Composite Samples

Compound	Census Region				Age Group, y			Race Group		Sex			
	North Central	Northeast	South	West	0–14	15–44	45+	White	Non-White	Male	Female	Nation	
Pesticides													
p,p-DDT	136 (17)	273 (21)	132 (18)	202 (25)	73.0 (36)	177 (16)	252 (13)	152 (15)	301 (25)	172 (16)	181 (15)	177 (11)	
p,p-DDE	1820 (17)	2310 (21)	2240 (16)	3240 (29)	1710 (22)	2150 (17)	3080 (13)	2250 (13)	2780 (25)	2240 (17)	2430 (15)	2340 (12)	
Beta-BHC	151 (28)	157 (35)	177 (24)	130 (43)	100 (52)	124 (33)	247 (15)	146 (21)	212 (32)	133 (30)	179 (20)	157 (16)	
Heptachlor epoxide	63.5 (12)	48.4 (19)	70.5 (10)	37.7 (25)	32.6 (23)	51.8 (12)	84.7 (6)	58.8 (8)	51.6 (19)	59.9 (10)	55.5 (10)	57.6 (7)	
Oxychlorane	104 (12)	107 (14)	126 (11)	113 (13)	52.7 (30)	119 (10)	150 (7)	116 (8)	103 (22)	122 (10)	106 (10)	114 (7)	
Trans-nonachlor	89.2 (29)	156 (21)	154 (17)	116 (29)	62.5 (51)	115 (22)	203 (11)	130 (14)	131 (32)	160 (15)	102 (22)	130 (12)	
Dieldrin	57.3 (24)	42.7 (41)	37.3 (37)	54.8 (32)	67.9 (25)	41.9 (31)	39.4 (29)	45.6 (21)	54.1 (41)	45.2 (28)	48.7 (24)	47.0 (17)	
Chlorobenzenes													
1,4-dichloro-benzene	98.1 (27)	77.4 (43)	126 (21)	35.7 (94)	101 (32)	66.2 (38)	120 (18)	76.6 (24)	162 (26)	108 (23)	75.0 (29)	90.9 (17)	
Hexachloro-benzene	41.2 (13)	57.6 (15)	41.7 (13)	74.7 (18)	35.0 (19)	47.0 (12)	69.8 (9)	51.9 (9)	48.2 (22)	52.3 (12)	50.4 (11)	51.3 (8)	
Polynuclear aromatic hydrocarbons (PAHs)													
Naphthalene	12.7 (20)	18.8 (24)	27.3 (18)	22.1 (27)	24.5 (23)	18.8 (17)	20.7 (14)	19.6 (13)	25.9 (24)	20.1 (16)	21.2 (15)	20.7 (11)	
PCBs													
Tetrachloro-benzene	66.2 (13)	78.8 (15)	46.9 (17)	34.0 (31)	19.4 (46)	41.8 (18)	105 (8)	53.0 (11)	73.0 (22)	40.7 (19)	71.2 (10)	56.4 (8)	
Pentachloro-benzene	165 (16)	202 (17)	107 (25)	64.2 (53)	75.6 (43)	107 (23)	218 (10)	133 (14)	141 (30)	115 (21)	153 (15)	135 (11)	
Hexachloro-benzene	282 (11)	430 (11)	299 (10)	250 (16)	101 (29)	306 (10)	481 (7)	289 (8)	435 (15)	294 (10)	332 (8)	314 (6)	
Heptachloro-benzene	101 (37)	213 (23)	109 (35)	85.5 (57)	26.9 (171)	112 (32)	217 (15)	111 (24)	195 (31)	148 (24)	104 (31)	125 (18)	
Other (qualitative)													
1-nonene	92.2 (95)	214 (52)	118 (74)	73.9 (153)	111 (97)	162 (52)	75.5 (97)	109 (56)	196 (72)	148 (56)	101 (73)	124 (41)	
Hexyl acetate	80.0 (46)	142 (33)	171 (22)	76.0 (63)	106 (43)	121 (29)	139 (22)	108 (24)	195 (31)	107 (32)	138 (23)	123 (18)	

Note. NHATS = National Human Adipose Tissue Survey; DDT = dichlorodiphenyltrichlor; DDE = dichlorodiphenylethylene; BHC = benzene hexachloride; PCB = polychlorinated biphenyl.

dard errors for national estimates ranged from 6% to 27% of the estimated value and were higher for the subpopulation estimates.

Note from Table 2 that the largest differences in average concentrations occur among the different age groups. Concentrations for most analytes increase with the age of the donor, suggesting that the level of body burden is an increasing function of age.

Of the PCB homologs included in statistical analysis, hexachlorobiphenyl was dominant. A table of the concentration distribution across the five homologs with the highest detection percentages, expressed as a percentage of total predicted concentration for these homologs, is available from the authors. The pentachlorobiphenyls, hexachlorobiphenyls, and heptachlorobiphenyls represent over 80% of the national average PCB concentration across the five homologs, with hexachlorobiphenyl representing 47% of the total. The distribution among homologs varies only slightly across the various demographic groups.

Analysis of Demographic Factors

Statistical hypothesis tests were performed for the 16 compounds in Table 2 to determine whether significant differences in estimated average concentration existed among census regions, age groups, race groups, or sexes. The attained significance levels from these tests are presented in Table 3. These levels represent the smallest significance level for which statistical differences are concluded to exist.

As Table 3 shows, the age group effect was most prevalent on concentration for several pesticides, hexachlorobenzene, and PCB homologs. In several cases, the attained significance levels were less than .001, indicating that for these compounds, the probability that observed age group differences were due purely to chance was less than 1 in 1,000. Table 2 indicates that the main pattern of age group differences observed in this study were increases with donor age. Significant differences across the four US Census regions were observed at the .05 level for p,p-dichlorodiphenyltrichlor (DDT), p,p-dichlorodiphenylethylene (DDE), heptachlor epoxide, hexachlorobenzene, naphthalene, and three PCB homologs, although the effects are generally not as pronounced as with age group. The effects of sex and race on these compounds were not significant at the .05 level.

TABLE 3—Significance Levels from Hypothesis Tests for Differences in Average Concentration Level between Demographic Groups in the FY 1986 NHATS

Compound	Effects Due to:			
	Census Region ^a	Age Group ^b	Sex ^c	Race Group ^c
Pesticides				
p,p-DDT	<.001**	<.001**	.966	.286
p,p-DDE	.001**	.009**	.814	.569
Beta-BHC	.947	.015*	.623	.501
Heptachlor epoxide	.031*	<.001**	.565	.846
Oxychlorodane	.616	<.001**	.483	.853
Trans-nonachlor	.187	<.001**	.321	.879
Dieldrin	.711	.359	.858	.808
Chlorobenzenes				
1,4-dichlorobenzene	.133	.182	.500	.327
Hexachlorobenzene	<.001**	<.001**	.777	.936
PAHs				
Naphthalene	.011*	.142	.830	.641
PCBs				
Tetrachlorobiphenyl	.037*	<.001**	.260	.337
Pentachlorobiphenyl	.009**	<.001**	.549	.619
Hexachlorobiphenyl	.047*	<.001**	.693	.244
Heptachlorobiphenyl	.140	<.001**	.490	.368
Other (qualitative)				
1-nonene	.782	.751	.764	.695
Hexyl acetate	.301	.826	.672	.445

Note. NHATS = National Human Adipose Tissue Survey; DDT = dichlorodiphenyltrichlor; DDE = dichlorodiphenylethylene; BHC = benzene hexachloride; PAH = polynuclear aromatic hydrocarbon; PCB = polychlorinated biphenyl.

^aLikelihood ratio tests based on the chi-square₍₃₎ distribution.

^bLikelihood ratio tests based on the chi-square₍₂₎ distribution.

^cLikelihood ratio tests based on the chi-square₍₁₎ distribution.

*Significant at the .05 level.

**Significant at the .01 level.

Comparison with Previous NHATS Results

One objective of the FY 1986 NHATS study was to compare levels of selected semivolatiles with those observed in the FY 1982 and FY 1984 NHATS. These two previous surveys were of interest as they also analyzed composite tissue samples for semivolatile levels using high-resolution gas chromatography/mass spectrometry methods and had similar specimen collection and composite designs. As was mentioned earlier, the FY 1986 NHATS design allowed valid statistical comparisons to be made between the FY 1986 survey results and the FY 1982 and FY 1984 survey results.

Of the 111 quantitative semivolatile compounds, 54 were analyzed in the FY 1986 NHATS and also in one or both of the FY 1982 and FY 1984 NHATS. However, statistical comparisons between surveys yield useful conclusions only when sufficient numbers of detectable results are available from each survey. Ten of the 54 compounds were considered for statis-

tical comparison across surveys, as they were detected in at least 50% of the composites within each survey, and their data met minimum quality-control standards. For these 10 compounds and total PCBs, Table 4 presents the estimated national average concentrations (and standard errors) for each of the three surveys.

For each compound in Table 4, two-sample *t* tests were performed to compare the national estimates from the FY 1986 survey to the FY 1982 and the FY 1984 surveys. Significant differences at the .05 level are denoted in Table 4. In the FY 1982 survey, the national estimates for the PCB homologs and total PCBs were lower than in the FY 1986 survey; the difference was highly significant for tetrachlorobiphenyls, pentachlorobiphenyls, and hexachlorobiphenyls, as well as for total PCBs. However, except for tetrachlorobiphenyls, some of this difference may be due to the use of different internal quantitation standards in the FY 1982 and FY 1986 surveys for the PCB homologs. A significant difference in the national esti-

TABLE 4—Comparisons of Predicted National Average Concentrations (ng/g) for Selected Semivolatiles in the FY 1982, FY 1984, and FY 1986 NHATS

Compound	FY 1982	FY 1984	FY 1986
	Mean (SE)	Mean (SE)	Mean (SE)
p,p-DDT ^a	189 (31)	123 (11)*	177 (20)
p,p-DDE ^{a,b}	1840 (350)	1150 (90)*	2340 (270)
Beta-BHC	291 (54)*	199 (24)	157 (25)
Trans-nonachlor ^a	109 (28)	105 (5)	130 (15)
Heptachlor epoxide	59.4 (13.4)	68.3 (7.1)	57.6 (4.2)
Hexachlorobenzene	118 (68)	42.9 (5.4)	51.3 (4.0)
Tetrachlorobiphenyl	15.7 (1.4)*	48.8 (5.9)	56.4 (4.7)
Pentachlorobiphenyl ^c	78.3 (7.9)*	115 (11)	135 (15)
Hexachlorobiphenyl ^a	176 (28)*	198 (11)*	314 (18)
Heptachlorobiphenyl ^a	84.6 (17.0)	129 (10)	125 (22)
Total PCBs ^d	407 (34.9)*	508 (19.5)*	672 (34.8)

Note. NHATS = National Human Adipose Tissue Survey; DDT = dichlorodiphenyltrichlor; DDE = dichlorodiphenylethylene; BHC = benzene hexachloride; PCB = polychlorinated biphenyl.

^aThe internal quantitation standards used in the FY 1982 analysis, were different from those used in the FY 1984 and FY 1986 analyses.

^bResults in FY 1986 NHATS were based on a lower response ion.

^cThe internal quantitation standards used in the FY 1984 analysis were different from those used in the FY 1982 and FY 1986 analyses.

^dSum of concentrations for tetrachlorobiphenyl to octachlorobiphenyl.

*Significantly different from the FY 1986 level at the .05 level.

mates for beta-benzene hexachloride (BHC) was also observed between FY 1982 and FY 1986; the FY 1986 estimate was 135 ng/g lower than the FY 1982 estimate. Both surveys used the same internal quantitation standards for quantitating beta-BHC.

A 115 ng/g increase in hexachlorobiphenyl from FY 1984 to FY 1986 was highly significant. An increase of 164 ng/g in total PCBs from FY 1984 to FY 1986 was also highly significant. Through a consideration of the estimated chlorobiphenyl distribution, hexachlorobiphenyl was the dominant PCB homolog in all three surveys. Increases from FY 1984 to FY 1986 in the national estimates for p,p-DDT and p,p-DDE were also significant at the .05 level. All three of these compounds were quantitated with the same internal quantitation standards in the FY 1984 and FY 1986 NHATS.

As noted above, a portion of the differences in estimates in the three surveys may be due to the type and number of internal quantitation standards used and their assignment to specific semivolatile compounds. Also, the FY 1984 NHATS was performed in a different laboratory than the other two surveys. Such potential sources of variation must be considered in interpreting differences observed in surveys.

Discussion

The FY 1986 NHATS resulted in estimated baseline levels for a wide variety of semivolatile organic compounds present in human adipose tissue. While the accuracy of estimates and statistical inferences must be considered relative to specific design and analytical approaches taken, the NHATS contributes to knowledge of potential environmental exposures to the general US population and various demographic subgroups.

Consistent with the findings of previous surveys, the FY 1986 NHATS observed that the levels of selected compounds found in adipose tissue generally increase with the age of the donor. For example, among the PCB homologs, the average concentration for the age group 45 years and older was from 188% (pentachlorobiphenyl) to 706% (heptachlorobiphenyl) above the average for the 0- through 14-year-old age group. Similar percentage increases with age were observed with pesticides.

Statistically significant differences between US Census regions were observed in average concentrations of p,p-DDT, p,p-DDE, heptachlor epoxide, hexachlorobenzene, naphthalene, and three PCB homologs. Average concentration of p,p-DDT and the PCBs were highest in the northeast. Heptachlor epoxide was high-

est in the South, and hexachlorobenzene and p,p-DDE were highest in the West.

The differences in estimated average concentrations between race groups (White vs non-White) and between sexes (male vs female) were not statistically significant for any of the 16 modeled compounds.

Despite the similarities between the FY 1982, FY 1984, and FY 1986 NHATS, the FY 1986 estimate of subpopulation concentrations were significantly different from earlier surveys for some PCB homologs and pesticides. In most cases, these differences indicated that FY 1986 estimates were higher than in the previous surveys. These results are contrary to the downward trends seen in previous trend analyses.¹³ These results, however, may be more likely to be due to analytical rather than environmental effects, especially since the time between surveys is relatively short. In making generalizations across the surveys, we must also consider the possible role of such analytical factors as differences in internal quantitation standards and surrogate compounds between surveys, and differences in design factors. □

Acknowledgments

We are grateful for the support of Cindy Stroup, Dr Joseph Breen, and Phil Robinson of the EPA's Office of Pollution Prevention and Toxics toward this work. We recognize the technical guidance of Janet Remmers of the EPA's Office of Pollution Prevention and Toxics and the technical contributions of Dr John Urban, Ying-Liang Chou, and Pamela Hartford of Battelle; Dr John Stanley, Dr Stan Spurlin, Hope Green, Patti Alm, and Dr Jack Balsinger of Midwest Research Institute; and John Rogers of Westat Inc. We also thank Richard W. Greene of the State of Delaware Department of Natural Resources for his important contributions to reporting the results of this analysis.

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Search Committee Seeks New Editor for *Medical Care*

An Editor Search Committee has begun a national search for a new editor of *Medical Care*. The seven-member search committee welcomes and solicits nominations and recommendations from the APHA membership and the readers of *Medical Care* to assist them in identifying the best available individual for this important editorship. The journal, which is sponsored by the Medical Care Section of the American Public Health Association and published by Lippincott-Raven, receives the support of a paid staff person who administers the review process and fulfills other duties the editor may choose to assign.

The following criteria will be considered by the search committee in selecting the editor for *Medical Care*:

- An advanced degree in an area related to the field of medical care and the evaluation of human health and health care, e. g., in public health, medicine, the allied health disciplines, or health services research.
- Comprehensive knowledge of the broad field of medical care, with an appreciation of its many disciplines, and a solid grounding in the scientific methods used in the evaluation of human health and health care, i.e., qualitative or quantitative analysis of health services, policy analysis, use of large data sets, epidemiology, statistics, and clinical trials.
- Demonstrated research skills, with evidence (through publication in peer-reviewed journals) of a firm grounding in areas of scientific inquiry related to medical care, e.g., research, planning, organization, financing, provision, and the evaluation of health services.
- Demonstrated writing, reviewing, and editing skills, enabling the following: authoritative advice to authors on the suitability of manuscripts, the informed consideration of reviewer assessments, guidance to authors during the revision process, and the preparation of editorials.
- Freedom to devote sufficient time to assure a high-quality journal. (The possibility of co-editorship is open.)
- Membership in the Medical Care Section of APHA, a working knowledge of the association and the section, including their respective missions, and a commitment to foster the advocacy goals of the association and the section.
- An institutional base is deemed highly desirable, preferably in an academic health science center, a school of public health, or a public health agency.

APHA supports equal opportunity and affirmative action in employment.

Self-nominations are welcome. The Search Committee will begin to review applications November 1, 1996.

Send names of potential candidates along with letters of endorsement and other support matter, to the following address:

Medical Care Search Committee
c/o Director of Human Resources
American Public Health Association
1015 15th Street, NW
Washington, DC 20005-2605